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11 April 1997

AGREEMENT

CONCERNING THE ADOPTION OF UNIFORM TECHNICAL PRESCRIPTIONS FOR WHEELED VEHICLES, EQUIPMENT AND PARTS WHICH CAN BE FITTED AND/OR BE USED ON WHEELED VEHICLES AND THE CONDITIONS FOR RECIPROCAL RECOGNITION OF APPROVALS GRANTED ON THE BASIS OF THESE PRESCRIPTIONS */

(Revision 2, including the amendments entered into force on 16 October 1995)

Addendum 99: Regulation No. 100

Date of entry into force: 23 August 1996

Incorporating corrections referred to in depositary notification C.N.12.1997.TREATIES-11 dated 12 February 1997

UNIFORM PROVISIONS CONCERNING THE APPROVAL OF BATTERY ELECTRIC VEHICLES WITH REGARD TO SPECIFIC REQUIREMENTS FOR THE CONSTRUCTION AND FUNCTIONAL SAFETY

UNITED NATIONS

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*/ Former title of the Agreement:

Agreement Concerning the Adoption of Uniform Conditions of Approval and Reciprocal Recognition of Approval for Motor Vehicle Equipment and Parts, done at Geneva on 20 March 1958.

GE.97-21042

Regulation No. 100

UNIFORM PROVISIONS CONCERNING THE APPROVAL OF BATTERY ELECTRIC VEHICLES WITH REGARD TO SPECIFIC REQUIREMENTS FOR THE CONSTRUCTION AND FUNCTIONAL SAFETY

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1. SCOPE

The following prescriptions apply to safety requirements with respect to all battery electric road vehicles of categories M and N, with a maximum design speed exceeding 25 km/h.

2. DEFINITIONS

For the purpose of this proposal:

2.1. "Battery electric road vehicle" means a vehicle with bodywork intended for road use, powered exclusively by an electric motor whose traction energy is supplied exclusively by a traction battery installed in the vehicle.

2.2. "Vehicle type" means battery electric road vehicles which do not differ in such essential aspects as:

dimensions, structure, shape and nature of constituting materials;
installation of the power system components, battery or battery packs;
nature and type of electric and electronic components.

2.3. "Approval of a type of battery electric road vehicle" means the approval of a type of electric vehicle regarding construction and functional safety requirements specific to the use of electric energy.

2.4. "Traction battery" means the assembly of all battery modules which are electrically connected, for the supply of energy of the power circuit.

2.5. "Battery module" means the smallest single energy storage consisting of one cell or an assembly of cells, electrically connected in serial or in parallel, placed in one container and mechanically associated.

2.6. "Battery pack" means a single mechanical assembly comprising battery modules and retaining frames or trays. A vehicle may have one or several, or no battery pack.

2.7. "Auxiliary battery" means the battery unit whose reserve of energy is used only for the auxiliary network supply.

2.8. "Auxiliary network" means the assembly of auxiliary electric equipment with similar functions to the one used on vehicles equipped with an internal combustion engine.

2.9. "On-board charger" means an energy electronic converter linked by construction to the vehicle and used for charging the traction battery from an external electric power supply (mains network).

2.10. "Coupling system" means all the parts used to connect the vehicle to an external electric power supply (alternative or direct current supply).

2.11. "Power train" means the electrical circuit including:

(i) the traction battery;

(ii) the electronic converters (on-board charger, electronic control of the traction motor, DC/DC converter, etc.);

(iii) the traction motors, the associated wiring harness and connectors, etc.

(iv) the charging circuit;

(v) the power auxiliary equipment (e.g. heating, defrosting, power steering, ...).

2.12. "Drive train" means specific components of power train: traction motors, electronic control of the traction motors, the associated wiring harness and connectors.

2.13. "Electronic converter" means an apparatus allowing the control and/or transfer of electric energy.

2.14. "Passenger and load compartment" means the space in the vehicle for occupant accommodation and bounded by the roof, floor, side walls, outside glazing, front bulkhead and the plane of the rear-seat back support and eventually the partition between it and the compartment(s) containing the battery or battery modules.

2.15. "Drive direction control unit" means a specific device physically actuated by the driver in order to select the drive direction (forwards or backwards), in which the vehicle will travel if the accelerator is actuated.

2.16. "Direct contact" means the contact of persons or livestock with live parts.

2.17. "Live parts" means any conductor or conductive part(s) intended to be electrically energised in normal use.

2.18. "Indirect contact" means contact of persons or livestock with exposed conductive parts.

2.19. "Exposed conductive part" means any conductive part which can readily be touched and which is not normally alive, but which may become electrically energised under fault conditions.

2.20. "Electrical circuit" means an assembly of connected live parts through which an electrical current is designed to pass in normal operation conditions;

2.21. "Active driving possible mode" means a vehicle mode when application of pressure to the accelerator pedal (or activation of an equivalent control) will cause the drive train to move the vehicle.

2.22. "Nominal voltage" means the root-mean-square (r.m.s.) value of the voltage specified by the manufacturer, for which the electrical circuit is designed and to which its characteristics are referred.

2.23. "Working voltage" means the highest root-mean-square (r.m.s.) value of an electrical circuit voltage, specified by the manufacturer, which may occur across any insulation, in open circuit conditions or under normal operating conditions.

2.24. "Electrical chassis" means a set made of conductive parts electrically linked together, and all other conductive parts electrically linked to them, whose potential is taken as a reference.

2.25. "Key" means any device designed and constructed to provide a method of operating a locking system which is designed and constructed to be operated only by that device.

3. APPLICATION FOR APPROVAL

3.1. The application for approval of a vehicle type with regard to specific requirements for the construction and functional safety of battery electric road vehicles shall be submitted by vehicle manufacturer or by his duly accredited representative.

3.2. It shall be accompanied by the under-mentioned documents in triplicate and following particulars:

3.2.1. Detailed description of the battery electric road vehicle type as regards to the shape of the bodywork, the electric drive train (motors and controllers), traction battery (type, capacity, battery management).

3.3. A vehicle representative of the vehicle type to be approved shall be submitted to the technical service responsible for conducting the approval tests.

3.4. The competent authority shall verify the existence of satisfactory arrangements for ensuring effective control of the conformity of production before type approval is granted.

4. APPROVAL

4.1. If the vehicle submitted for approval pursuant to this regulation meets the requirements of paragraph 5 below and annexes 3, 4 and 5 to this Regulation, approval of this vehicle type shall be granted.

4.2. An approval number shall be assigned to each type approved. Its first two digits (at present 00 for the Regulation in its original form) shall indicate the series of amendments incorporating the most recent major technical amendments made to the Regulation at the time of issue of the approval. The same Contracting Party shall not assign the same number to another vehicle type.

4.3. Notice of approval or of refusal or of extension or withdrawal of approval or production definitely discontinued of a vehicle type pursuant to this Regulation shall be communicated to the Parties to the Agreement applying this Regulation, by means of a form conforming to the model in annex 1 to this Regulation.

4.4. There shall be affixed, conspicuously and in a readily accessible place specified on the approval form, to every vehicle conforming to a vehicle type approved under this Regulation an international approval mark consisting of:

4.4.1. A circle surrounding the letter "E" followed by the distinguishing number of the country which has granted approval. 1/

4.4.2. The number of this Regulation, followed by the letter "R", a dash and the approval number to the right of the circle described in paragraph 4.4.1.

4.5. If the vehicle conforms to a vehicle type approved under one or more other Regulations annexed to this Agreement in the country which has granted approval under this Regulation, the symbol prescribed in paragraph 4.4.1. need not be repeated; in this case the Regulation and approval numbers and the additional symbols of all the Regulations under which approval has been granted in the country which has granted approval under this Regulation shall be placed in vertical columns to the right of the symbol prescribed in paragraph 4.4.1.

4.6. The approval mark shall be clearly legible and shall be indelible.

1/ 1 for Germany, 2 for France, 3 for Italy, 4 for the Netherlands, 5 for Sweden, 6 for Belgium, 7 for Hungary, 8 for the Czech Republic, 9 for Spain, 10 for Yugoslavia, 11 for the United Kingdom, 12 for Austria, 13 for Luxembourg, 14 for Switzerland, 15 (vacant), 16 for Norway, 17 for Finland, 18 for Denmark, 19 for Romania, 20 for Poland, 21 for Portugal, 22 for the Russian Federation, 23 for Greece, 24 (vacant), 25 for Croatia, 26 for Slovenia, 27 for Slovakia, 28 for Belarus, 29 for Estonia, 30-36 (vacant) and 37 for Turkey. Subsequent numbers shall be assigned to other countries in the chronological order in which they ratify or accede to the Agreement concerning the Recognition of Approval for Motor Vehicle Equipment and Parts, and the numbers thus assigned shall be communicated by the Secretary-General of the United Nations to the Contracting Parties to the Agreement.

4.7. The approval mark shall be placed on or close to the vehicle data plate affixed by the manufacturer.

4.8. Annex 2 to this Regulation gives examples of the arrangements of the approval mark.

5. SPECIFICATIONS AND TESTS

5.1. Vehicle construction requirements

5.1.1. Traction battery

5.1.1.1. Installation of the traction battery in the vehicle shall not allow any potential dangerous accumulation of gas pockets.

5.1.1.2. Battery compartments containing battery modules which may produce hazardous gases shall be safely ventilated.

5.1.1.3. The traction battery and the power train shall be protected by properly rated fuses or circuit breakers. The manufacturer shall supply data to the laboratory which allows verification that their calibration ensures opening, if necessary;

5.1.2. Protection against electric shock

5.1.2.1. Protection against direct contact with live parts of the power train:

5.1.2.1.1. If the working voltage of the electric circuit is lower than 60 volts DC or 25 volts AC, no requirements are necessary;

5.1.2.1.2. Direct contact with live parts of the electrical power train whose maximum voltage is at least 60 volts DC or 25 volts AC shall be prevented either by insulation or by the use of covers, protection grills, perforated metal sheets, etc. These protections shall be reliably secured and shall be mechanically resistant. They shall not be able to be opened, disassembled or removed without the use of tools.

5.1.2.1.3. In passenger and load compartments live parts in any case shall be protected by enclosures having a protection degree of at least IPXXD.

5.1.2.1.4. Enclosures in other areas of the vehicle shall have a protection degree of at least IPXXB.

5.1.2.1.5. In the engine compartment the access to live parts shall only be possible with voluntary action.

5.1.2.1.6. After opening the cover, the access to the parts of the coupling system shall be protected with IPXXB protection.

5.1.2.1.7. Protection degrees IPXXB and IPXXD are related respectively, to the contact of a jointed test finger and a test wire with hazardous parts (annex 3).

5.1.2.1.8. Vehicle markings

Protection covers of live parts described in paragraph 5.1.2.1.2. shall be marked by a symbol as described in annex 5.

5.1.2.2. Protection against indirect contacts with exposed conductive parts of the power train.

5.1.2.2.1. If the working voltage of the electric circuit is lower than 60 volts DC or 25 volts AC, no requirements are necessary;

5.1.2.2.2. The design, installation, and manufacture of electric material shall be such that insulation failures are avoided;

5.1.2.2.3. Protection against indirect contacts shall be ensured by using insulation and additionally, the exposed conductive parts of the on-board equipment shall be galvanically connected together. This potential equalisation is obtained by connecting the exposed conductive parts together either by a protective conductor, e.g. wire, ground truss, or directly by the vehicle metallic chassis. Two exposed conductive parts welded together are considered as having no discontinuity points. If there is some discontinuity, this point shall be by-passed by potential equalisation.

5.1.2.3. Insulation resistance

5.1.2.3.1. The insulation resistance measurement is performed after maintaining the vehicle for a conditioning time of 8 hours with the following conditions:

temperature:	23 ± 5 °C,
humidity:	90 % +10/-5 %.

5.1.2.3.2. Using a measuring DC voltage equal to the nominal voltage of the traction battery, insulation resistances between any exposed conductive part and each polarity of the battery shall have a minimum value of 500 Ω/V of the nominal voltage (annex 4 contains an example of how this test may be conducted).

5.1.2.3.3. Resistance of the protective conductor:

The potential equalisation resistance between any two exposed conductive parts shall be lower than 0.1 Ω. This test shall be performed by a current of at least 0.2 A.

5.1.2.4. Connection of the vehicle to the mains network:

5.1.2.4.1. In no case the vehicle shall be capable to move by its own means when it is galvanically connected to an energy supply network or to an off board charger;

5.1.2.4.2. The components used when charging the battery from an external source shall allow the charging current to be cut in case of disconnection without physical damage;

5.1.2.4.3. The coupling system parts likely to be live shall be protected against any direct contact in all operating conditions;

5.1.2.4.4. All exposed conductive parts shall be electrically linked through a conducting wire plugged to earth when charging.

5.2. Functional safety requirements

5.2.1 Power on procedure:

5.2.1.1. The power on procedure shall be applied via a key switch.

5.2.1.2. It shall not be possible to remove this key in any position that energises the drive train or makes active driving possible.

5.2.2. Running and stopping conditions:

5.2.2.1. At least a momentary indication must be given to the driver either:

(a) when the vehicle is in "active driving possible mode" or,

(b) when one further action is required to place the vehicle in "active driving possible mode".

5.2.2.2. When the state of charge of the battery reaches the minimum state of charge value defined by the manufacturer, the user shall be warned to perceive this situation quickly enough to be able to drive the vehicle, on its own power, at least out of the traffic zone.

5.2.2.3. Unintentional acceleration, deceleration and reversal of the drive train shall be prevented. In particular, a failure (e.g. in the power train) shall not cause more than 0.1 m movement of a standing unbraked vehicle.

5.2.2.4. When leaving the vehicle, the driver shall be informed by an obvious signal (e.g. optical or audible signal) if the drive train is still in the active driving possible mode.

5.2.3. Reversing

5.2.3.1. Reversing shall be possible only after operation of a specific control. This action shall require either:

(a) the combination of two different actuations, or

(b) an electric switch which allows reverse to be engaged only when the vehicle is moving at a forward speed not exceeding 5 km/h. Above this speed all actions on this device shall be ignored. The device shall have only one stable position.

5.2.3.2. The state of the drive direction control unit shall be readily identified to the driver.

5.2.4. Emergency power reduction

5.2.4.1. If the vehicle is equipped with a device to limit the performance in an emergency (e.g. overheating of a component) the user shall be informed by an obvious signal.

6. MODIFICATIONS AND EXTENSION OF THE TYPE APPROVAL FOR VEHICLE TYPE

6.1. Every modification of the vehicle type shall be notified to the administrative department which approved the vehicle type. The department may then either:

6.1.1. consider that the modifications made are unlikely to have an appreciable adverse effect and that in any case the vehicle still complies with the requirements or

6.1.2. require a further test report from the technical service responsible for conducting the tests.

6.2. Confirmation or refusal of approval, specifying the alteration shall be communicated by the procedure specified in paragraph 4.3. above to the Parties to the Agreement applying this Regulation.

6.3. The competent authority issuing the extension of approval shall assign a series number for such an extension and inform thereof the other Parties to the 1958 Agreement applying the Regulation by means of a communication form conforming to the model in annex 1 to this Regulation.

7. CONFORMITY OF PRODUCTION

7.1. Every vehicle approved under this Regulation shall be so manufactured as to conform to the type approved by meeting the requirements set out in paragraph 5. above.

7.2. In order to verify that the requirements of paragraph 7.1. are met, suitable controls of the production shall be carried out.

7.3. The holder of the approval shall, in particular:

7.3.1. ensure the existence of procedures for the effective quality control of vehicles;

7.3.2. have access to the testing equipment necessary for checking the conformity of each approved type;

7.3.3. ensure that test result data are recorded and that the annexed documents remain available for a period to be determined in agreement with the administrative department;

7.3.4. analyze the results of each type of test, in order to verify and ensure the consistency of characteristics of the vehicle, making allowance for permissible variations in industrial production;

7.3.5. ensure that for each type of vehicle at least the tests prescribed in paragraph 5. of this Regulation are carried out;

7.3.6. ensure that any set of samples or test pieces giving evidence of non-conformity with the type of test in question shall give rise to a further sampling and test. All the necessary steps shall be taken to re-establish conformity of the corresponding production.

7.4. The competent authority which has granted type approval may at any time verify the conformity control methods applied in each production unit.

7.4.1. At every inspection, the test records and production records shall be presented to the visiting inspector.

7.4.2. The inspector may take samples at random to be tested in the manufacturer's laboratory. The minimum number of samples may be determined according to the results of the manufacturer's own checks.

7.4.3. When the quality level appears unsatisfactory or when it seems necessary to verify the validity of the tests carried out in application of paragraph 7.4.2., the inspector shall select samples to be sent to the technical service which has conducted the type approval tests.

7.4.4. The competent authority may carry out any test prescribed in this Regulation.

7.4.5. The normal frequency of inspections by the competent authority shall be one per year. If unsatisfactory results are recorded during one of these visits, the competent authority shall ensure that all necessary steps are taken to re-establish the conformity of production as rapidly as possible.

8. PENALTIES FOR NON-CONFORMITY OF PRODUCTION

8.1. The approval granted in respect of a vehicle type, pursuant to this Regulation may be withdrawn if the requirements laid down in paragraph 7. are not complied with, or if the vehicle or its components fail to pass the tests provided for in paragraph 7.3.5. above.

8.2. If a Contracting Party to the Agreement applying this Regulation withdraws an approval it has previously granted, it shall forthwith so notify the other Contracting Parties applying this Regulation, by means of a communication form conforming to the model in annex 1 to this Regulation.

9. PRODUCTION DEFINITELY DISCONTINUED

If the holder of the approval completely ceases to manufacture a type of vehicle approved in accordance with this Regulation, he shall so inform the authority which granted the approval. Upon receiving the relevant communication, that authority shall inform thereof the other Contracting Parties to the 1958 Agreement applying this Regulation by means of a communication form conforming to the model in annex 1 to this Regulation.

10. NAMES AND ADDRESSES OF TECHNICAL SERVICES RESPONSIBLE FOR CONDUCTING APPROVAL TESTS AND OF ADMINISTRATIVE DEPARTMENTS.

The Contracting Parties to the 1958 Agreement applying this Regulation shall communicate to the United Nations secretariat the names and addresses of the technical services responsible for conducting approval tests and the administrative departments which grant approval and to which forms certifying approval or extension or refusal or withdrawal of approval or production definitely discontinued, issued in other countries, are to be sent.

Annex 1

(maximum format: A4 (210 x 297 mm))

COMMUNICATION

issued by: Name of administration:
.....
.....
.....

Concerning : 2/ APPROVAL GRANTED,
APPROVAL EXTENDED,
APPROVAL REFUSED,
APPROVAL WITHDRAWN,
APPROVAL DEFINITELY DISCONTINUED,

of a battery electric road vehicle pursuant to Regulation No. 100

Approval No. ..... Extension No. .....

1. Trade name or mark of the vehicle .....
2. Vehicle type .....
3. Vehicle category .....
4. Manufacturer's name and address .....
5. If applicable, name and address of manufacturer's representative .....
6. Vehicle submitted for approval on .....
7. Technical service responsible for conducting approval tests .....
8. Date of report issued by that service .....
9. Number of report issued by that service .....
10. Location of the approval mark .....
11. Reason(s) for extension of approval (if applicable) 2/ .....
12. Approval granted/extended/refused/withdrawn 2/ .....
13. Place .....
14. Date .....
15. Signature .....
16. The documents filed with the request for approval or extension may be obtained on request.

Notes:

1/ Distinguishing number of the country which has granted/extended/refused/withdrawn approval (see approval provisions in the Regulation).

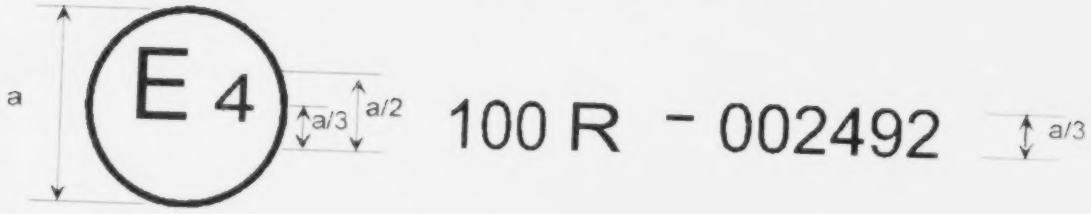
2/ Strike out what does not apply.

Annex 2

ARRANGEMENTS OF APPROVAL MARKS

Model A

(see paragraph 4.4. of this Regulation)

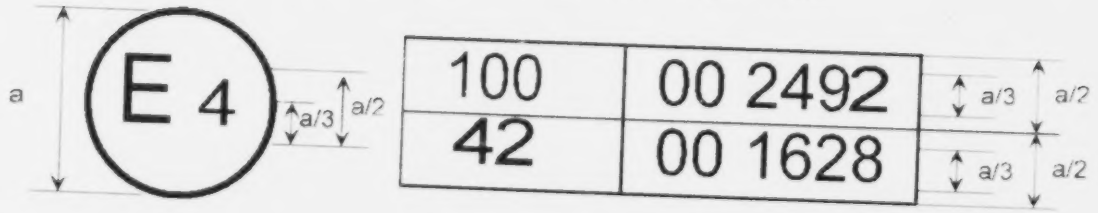


a = 8 mm min.

The above approval mark affixed to a vehicle shows that the battery electric road vehicle type concerned has been approved in the Netherlands (E4), pursuant to Regulation No. 100, and under the approval number 002492. The first two digits of the approval number indicate that the approval was granted in accordance with the requirements of Regulation No. 100 in its original form.

Model B

(see paragraph 4.5. of this Regulation)



a = 8 mm min.

The above approval mark affixed to a vehicle shows that the battery electric road vehicle concerned has been approved in the Netherlands (E4) pursuant to Regulations Nos. 100 and 42 */. The first two digits of the approval numbers indicate that, at the dates when respective approvals were granted, both Regulations Nos. 100 and 42 were in their original form.

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*/ The latter number is given only as an example.

Annex 3

PROTECTION AGAINST DIRECT CONTACTS OF PARTS UNDER VOLTAGE
Extract from the IEC 529 Standard (1989)

1. DEFINITIONS

For the purpose of this standard, the following definitions apply:

1.1. Enclosure

A part providing protection of equipment against certain external influences and, in any direction, protection against direct contact (IEV 826-03-12).

Note: This definition taken from the existing International Electrotechnical Vocabulary (IEV) needs the following explanations under the scope of this standard:

(a) Enclosures provide protection of persons (or livestock) against access to hazardous parts.

(b) Barriers, shapes of openings or any other means - whether attached to the enclosure or formed by the enclosed equipment - suitable to prevent or limit the penetration of the specified test probes are considered as a part of the enclosure, except when they can be removed without the use of a key or tool.

1.2. Direct contact

Contact of persons (or livestock) with live parts (IEV 826-03-05).

Note: This IEV definition is given for information. In this standard "Direct contact" is replaced by "Access to hazardous parts".

1.3. Degree of protection

The extent of protection provided by an enclosure against access to hazardous parts, against ingress of solid foreign objects and/or against ingress of water and verified by standardised test methods.

1.4. IP code

A coding system to indicate the degrees of protection provided by an enclosure against access to hazardous parts, ingress of solid foreign objects, ingress of water and to give additional information in connection with such protection.

1.5. Hazardous part

A part that is hazardous to approach or touch.

1.5.1. Hazardous live part

A live part which, under certain conditions of external influences, can give an electric shock (see IEC 536, at present Document 64(CO)196).

1.5.2. Hazardous mechanical part

A moving part, other than a smooth rotating shaft, that is hazardous to touch.

1.6. Protection provided by an enclosure against access to hazardous parts.

The protection of persons against:

(a) contact with hazardous low-voltage live parts;

(b) contact with hazardous mechanical parts;

(c) approach to hazardous high-voltage live parts below adequate clearance inside an enclosure.

Note: This protection may be provided:

(a) by means of the enclosure itself;

(b) by means of barriers as part of the enclosure or distances inside the enclosure.

1.7. Adequate clearance for protection against access to hazardous parts

A distance to prevent contact or approach of an access probe to a hazardous part.

1.8. Access probe

A test probe simulating in a conventional manner a part of a person or a tool, or the like, held by a person to verify adequate clearance from hazardous parts.

1.9. Object probe

A test probe simulating a solid foreign object to verify the possibility of ingress into an enclosure.

1.10. Opening

A gap or aperture in an enclosure which exists or may be formed by the application of a test probe at the specified force.

2. TESTS FOR PROTECTION AGAINST ACCESS TO HAZARDOUS PARTS INDICATED BY THE ADDITIONAL LETTER

2.1. Access probes

Access probes to verify the protection of persons against access to hazardous parts are given in table 1.

2.2. Test conditions

The access probe is pushed against any openings of the enclosure with the force specified in table 1. If it partly or fully penetrates, it is placed in every possible position, but in no case shall the stop face fully penetrate through the opening.

Internal barriers are considered part of the enclosure as defined in paragraph 1.1.

For tests on low-voltage equipment, a low-voltage supply (of not less than 40 V and not more than 50 V) in series with a suitable lamp should be connected between the probe and the hazardous parts inside the enclosure. Hazardous live parts covered only with varnish or paint, or protected by oxidation or by a similar process, are covered by a metal foil electrically connected to those parts which are normally live in operation.

The signal-circuit method should also be applied to the hazardous moving parts of high-voltage equipment.

Internal moving parts may be operated slowly, where this is possible.

2.3. Acceptance conditions

The protection is satisfactory if adequate clearance is kept between the access probe and hazardous parts.

In the case of the test for the additional letter B, the jointed test finger may penetrate to its 80 mm length, but the stop face (Ø 50 mm x 20 mm) shall not pass through the opening. Starting from the straight position, both joints of the test finger shall be successively bent through an angle of up to 90° with respect to the axis of the adjoining section of the finger and shall be placed in every possible position.

In case of the tests for the additional letter D, the access probe may penetrate to its full length, but the stop face shall not fully penetrate through the opening. See annex A for further clarification.

Conditions for verification of adequate clearance are identical with those given in paragraph 2.3.1. below.

2.3.1. For low-voltage equipment (rated voltages not exceeding 1,000 V AC and 1,500 V DC):

The access probe shall not touch hazardous live parts.

If adequate clearance is verified by a signal circuit between the probe and hazardous parts, the lamp shall not light.

Table 1 - Access probes for the tests for protection of persons against access to hazardous parts

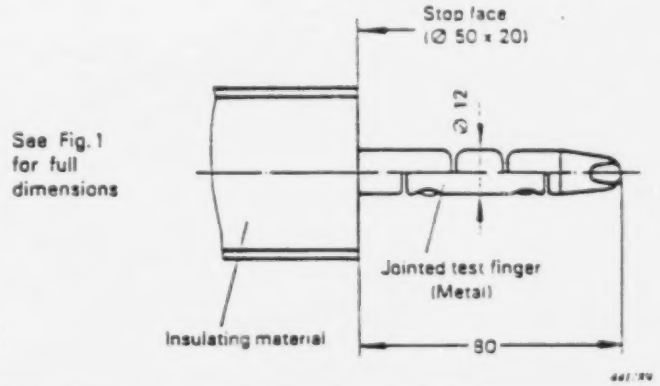
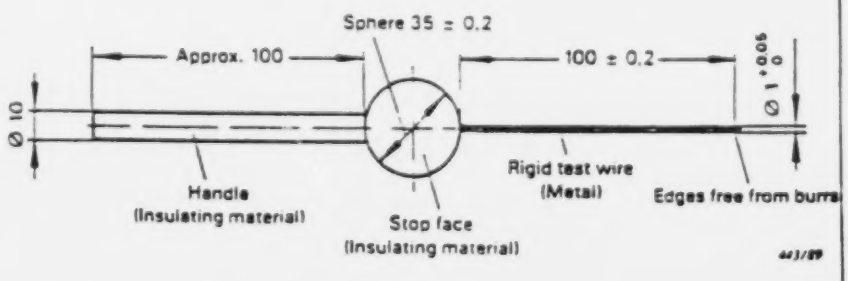
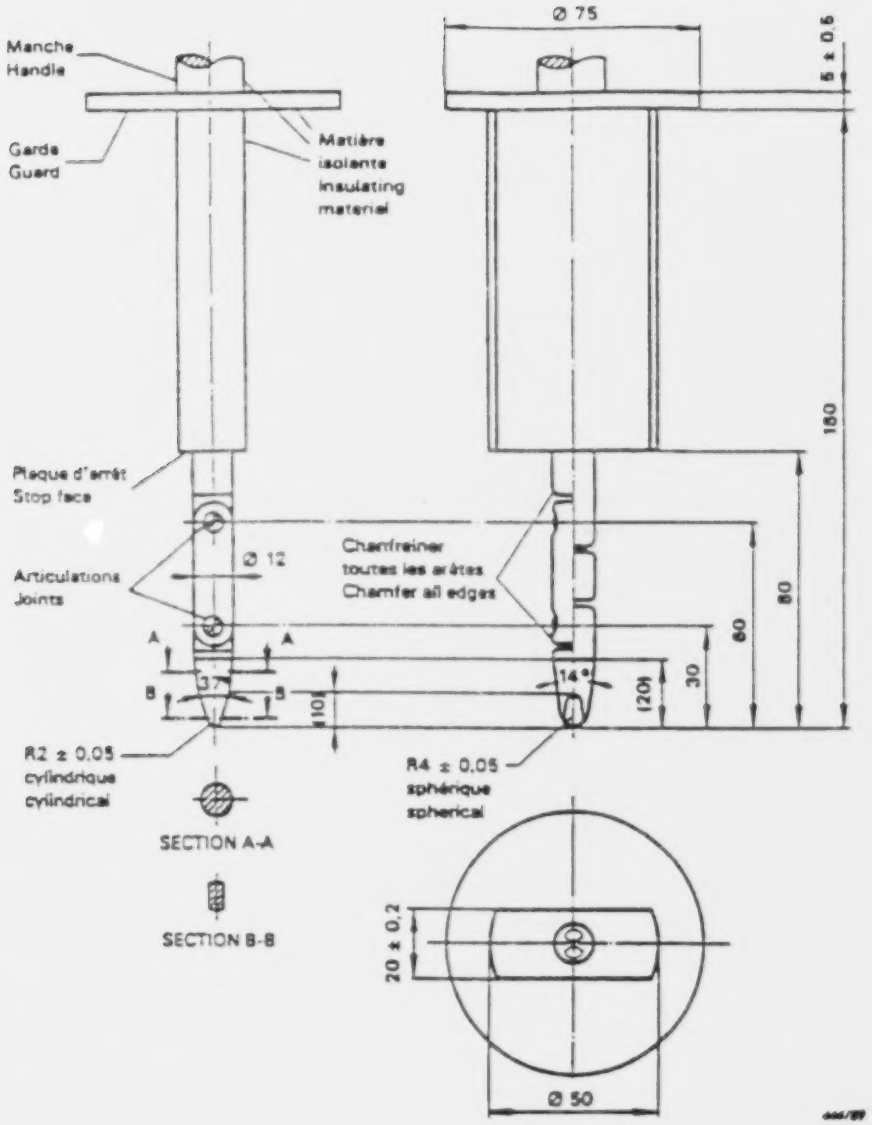
First numeral	Addit. letter	Access probe	Test force
2	B	*Jointed test finger 	10 N ± 10%
4.5.6	D	Test wire 1.0 mm diameter 100 mm long 	1 N ± 10%

Figure 1 - Jointed test finger



Material: metal, except where otherwise specified

Linear dimensions in millimetres

Tolerances on dimensions without specific tolerance:

on angles: 0/−10°

on linear dimensions:
up to 25 mm: 0/−0.05
over 25 mm: ±0.2

Both joints shall permit movement in the same plane and the same direction through an angle of 90° with a 0 to +10° tolerance.

Annex 4

MEASUREMENT OF THE INSULATION RESISTANCE USING THE TRACTION BATTERY

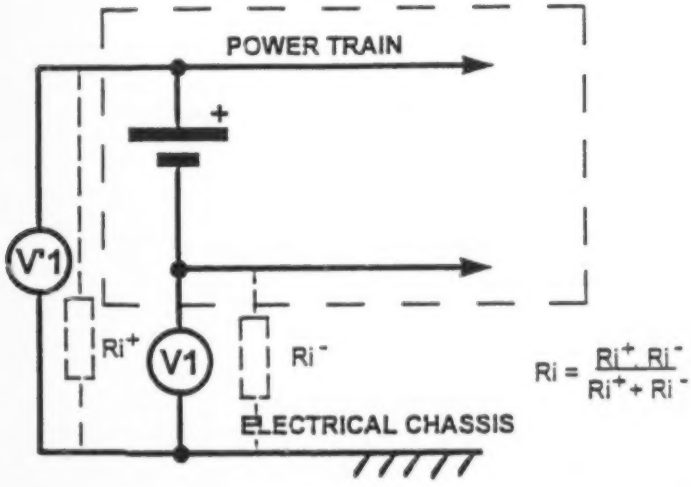
1. DESCRIPTION OF THE TEST METHOD

The traction battery shall be fully charged

The voltmeter used in this test shall measure DC values and have an internal resistance greater than 10 MΩ.

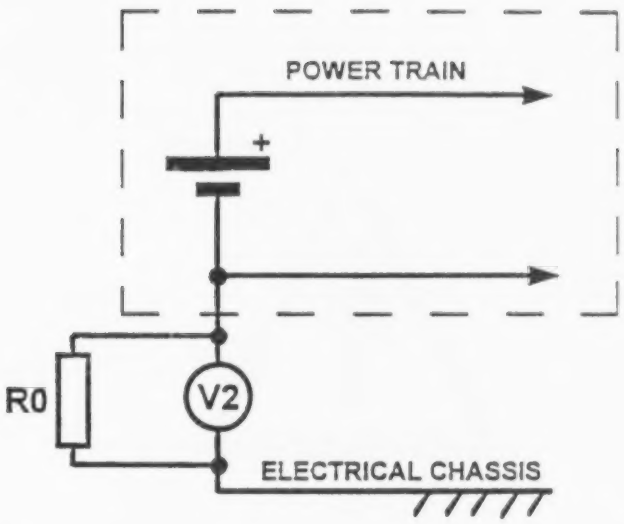
Measurement shall be made in two steps:

Step one:

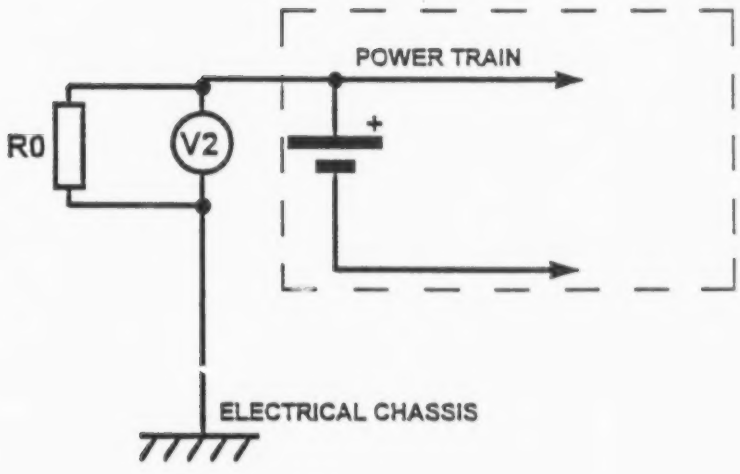


Measure V_1 and V'_1.

Step two:



if V1 > V'1



if V1 < V'1

where Ro is a resistance of 500 Ω/V

The value of the insulation resistance Ri is given by one of the formula:

$$Ri = \frac{V1-V2}{V2} \times Ro \qquad or \qquad Ri = \frac{V'1-V2}{V2} \times Ro$$

Annex 5

SYMBOL FOR OF THE INDICATION OF A VOLTAGE
(Reference to ISO 3864 and IEC 417k standards)

Black on a yellow ground

Annex 6

ESSENTIAL CHARACTERISTICS OF THE VEHICLE

1. General description of vehicle

1.1. Trade name or mark of the vehicle: . . . . . .
1.2. Vehicle type: . . . . . .
1.3. Manufacturer's name and address: . . . . . .
1.4. If applicable, name and address of manufacturer's representative: . . . . . .
1.5. Brief description of the power circuit components installation or drawings/pictures showing the location of the power circuit components installation: . . . . . .
1.6 Schematic diagram of all electrical functions included in power circuit: . . . . . .
1.7. Working voltage: V
1.8. Drawing and/or photograph of the vehicle:

2. Description of motor(s)

2.1. Make: . . . . . .
2.2. Type: . . . . . .
2.3. Working principle: . . . . . .
2.3.1. Direct current/alternative current/number of phases 1/
2.3.2. Excitation: separate/shunt/series/compound 1/
2.3.3. Synchron/asynchron 1/
2.3.4. Cooling system: air/liquid 1/

3. Description of transmission

3.1. Type: manual/automatic/none/others (to specify): 1/ . . . . . .
3.2. Transmission ratios: . . . . . .
3.3. Dimension of tyres: . . . . . .

4. Traction battery

4.1. Trade name and mark of the battery: . . . . . .
4.2. Indication of all types of electric-chemical couples used: . . . . . .
4.2.1. Nominal voltage: V
4.3. Type(s) of ventilation for battery module/pack: 1/ . . . . . .
4.4. Description of cooling system (if any): . . . . . .
4.5. Brief description of maintenance procedure (if any): . . . . . .
4.6. Battery energy: . . . . . kW.h
4.7. End of discharge voltage value: V

5. Power train electronic converters and power auxiliary equipment

5.1. Brief description of each electronic converter and auxiliary equipment: . . . . . .

5.2. Make of electronic converter assembly: . . . . . .
5.3. Type of electronic converter assembly: . . . . . .
5.4. Make of each auxiliary equipment: . . . . . .
5.5. Type of each auxiliary equipment: . . . . . .
5.6. Charger : on board/external 1/
5.7. Specification of mains:
5.7.1. Type of mains: single phase/three phase 1/
5.7.2. Voltage: V

6. Fuse and/or circuit breaker

6.1. Type: . . . . . .
6.2. Diagram showing the functional range: . . . . . .

7. Power wiring harness

7.1. Type: . . . . . .

1/ Strike out what does not apply.